CLAIMS

1. A method of modifying the force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion, which causes the force of contraction to be increased by at least 5%.

2. A method according to claim 1, wherein the force is increased by at least 10%.

3. A method according to claim 1, wherein the force is increased by at least 30%.

4. A method according to claim 1, wherein the force is increased by at least 50%.

5. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field having a given duration, to the portion at a delay of less than 70 msec after the activation.

6. A method of modifying the force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion, which causes the pressure in the chamber to be increased by at least 2%.

7. A method according to claim 6, wherein the pressure is increased by at least 10%.

8. A method according to claim 6, wherein the pressure is increased by at least 20%.

9. A method of modifying the force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion, wherein the chamber has a flow volume and wherein the flow volume is increased by at least 5%.

10. A method according to claim 9, wherein the volume is increased by at least 10%.

11. A method according to claim 9, wherein the volume is increased by at least 20%.

12. A method of modifying the force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion, wherein the chamber has a flow rate such that the flow rate is increased by at least 5%.

13. A method according to claim 12, wherein the rate is increased by at least 10%.

14. A method according to claim 12, wherein the rate is increased by at least 20%.

15. A method of modifying the force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field to the portion at a delay after the activation, the field having a given duration of at least 101 msec and not lasting longer than the cycle length.

16. A method according to claim 15, wherein the duration is at least 120 msec.

17. A method according to claim 15, wherein the duration is at least 150 msec.

18. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion,

wherein the portion of the chamber has an inner surface and an outer surface and wherein the field is applied between the inner surface and the outer surface.

19. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion,

wherein the portion of the chamber has an inner surface and an outer surface and wherein the field is applied along the outer surface.

20. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion,

wherein the portion of the chamber has an inside surface, an outside surface and an intra-muscle portion and wherein the field is applied between the intra-muscle portion and at least one of the surfaces.

21. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion,

wherein the field is applied between a single electrode and a casing of an implanted device.

22. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion, using an electrode floating inside the heart.

23. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation:

and

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion,

wherein the field is applied using at least two electrodes and wherein the at least two electrodes are at least 2 cm apart.

24. A method according to claim 23, wherein the electrodes are at least 4 cm apart.

25. A method according to claim 23, wherein the electrodes are at least 9 cm apart.

26. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion,

wherein the field is applied using at least two electrodes and wherein one electrode of the at least two electrodes is at a base of a chamber of the heart and one electrode is at an apex of a chamber of the heart.

27. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion,

wherein the field is applied using at least three electrodes and wherein applying a non-excitatory field comprises:

electrifying a first pair of the at least three electrodes; and

subsequently electrifying a second pair of the at least three electrodes.

28. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion, wherein the field is applied using at least two electrodes placed externally to the subject.

29. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion,

wherein the electric field at least partially cancels electro-tonic currents in at least the portion of the heart chamber.

30. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion between two positions; and

sensing an activation at a site between the two positions.

31. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion between two positions; and

sensing an activation at a site coinciding with one of the two positions.

32. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion between two positions;

sensing an activation at a site; and

estimating the activation of the portion from the sensed activation.

33. A method according to claim 32, wherein sensing comprises sensing a value of a parameter of an ECG and wherein estimating comprises estimating the delay based on a delay value associated with the value of the parameter.

34. A method according to claim 32, wherein the site is at a different chamber of the heart than the chamber at which the field is applied.

35. A method according to claim 32, wherein the site is substantially the earliest activated site

in the chamber of the portion.

36. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion; and

applying a second non-excitatory electric field to a second portion of the chamber.

37. A method according to claim 36, wherein the second field is applied in the same cardiac cycle as the non-excitatory field.

38. A method according to claim 37, wherein each portion has an individual activation to which the applications of the field thereat are synchronized.

39. A method according to claim 37, wherein the second field has a different effect on the heart than the non-excitatory field.

40. A method according to claim 36, wherein only the second non-excitatory field is applied during a different cardiac cycle.

41. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

estimating the activation at the portion; and

applying a non-excitatory electric field having a given duration, at a delay after the estimated activation, to the portion.

42. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion; and

repeating application of the non-excitatory field, during a plurality of later heart beats, at least some of which are not consecutive.

43. A method according to claim 42, comprising gradually reducing the frequency at which beats are skipped during the repeated application.

44. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field having a given duration, at a delay after the activation, to the portion, wherein the portion has an extent; and

changing the extent of the portion to which the field is applied, between beats.

45. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

irradiating the portion with light synched to the activation; and

repeating irradiating at at least 100 cardiac cycles, during a period of less than 1000 cardiac cycles.

46. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

irradiating the portion with radio frequency radiation synched to the activation; and

repeating irradiating at at least 100 cardiac cycles, during a period of less than 1000 cardiac cycles.

47. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

modifying the availability of calcium ions inside muscle fibers of the portion, during a period of time including a time less than 70 msec after the activation, in response to the activation.

48. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

modifying the transport rate of calcium ions inside muscle fibers of the portion, during a period of time less than 70 msec after the activation, in response to the activation.

49. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

and

modifying the availability of catecholamines at the portion in synchrony with the activation.

50. A method of modifying the activation profile of at least a portion of a heart, comprising,

mapping the activation profile of the portion;

determining a desired change in the activation profile; and

modifying, using a non-excitatory electric field, the conduction velocity in a non-arrhythmic segment of the portion, to achieve the desired change.

51. A method according to claim 50, wherein the desired change is an AV interval and wherein modifying comprises modifying the conduction velocities of purkinje fibers between an AV node and at least one of the ventricles in the heart.

52. A method in accordance with any of claims 1-44, wherein the activation comprises an average activation of the portion.

53. A method according to any of claims 1-44, wherein the activation comprises an earliest activation.

54. A method according to any of claims 1-44, wherein the activation comprises a mechanical activation.

55. A method according to any of claims 1-44, wherein the activation comprises an electrical activation.

56. A method in accordance with any of claims 1-44, wherein the portion comprises a plurality of subportions, each having an individual activation and wherein applying a field comprises applying a field to each subportion at a delay relative to the individual activation of the subportion.

57. A method in accordance with any of claims 1-44, wherein applying a non-excitatory electric field comprises driving an electric current through the segment.

58. A method in accordance with claim 57, wherein the current is less than 20 mA.

59. A method in accordance with claim 57, wherein the current is less than 8 mA.

60. A method in accordance with claim 57, wherein the current is less than 5 mA.

61. A method in accordance with claim 57, wherein the current is less than 3 mA.

62. A method in accordance with claim 57, wherein the current is at least .5 mA.

63. A method in accordance with claim 57, wherein the current is at least 1 mA.

64. A method in accordance with claim 57, wherein the current is at least 3 mA.

65. A method in accordance with any of claims 1-14 or 18-44, wherein the field is applied for a duration of between 10 and 140 msec.

66. A method in accordance with any of claims 1-14 or 18-44, wherein the field is applied for a duration of between 30 and 100 msec.

67. A method in accordance with any of claims 1-14 or 18-44, wherein the field is applied for a duration of between 60 and 90 msec.

68. A method according to any of claims 1-4 or 6-44, wherein the delay is less than 70 msec.

69. A method according to any of claims 1-44, wherein the delay is less than 40 msec.

70. A method according to any of claims 1-44, wherein the delay is less than 20 msec.

71. A method according to any of claims 1-44, wherein the delay is less than 5 msec.

72. A method according to any of claims 1-44, wherein the delay is less than 1 msec.

73. A method according to any of claims 1-44, wherein the delay is substantially zero.

74. A method according to any of claims 1-44, wherein the delay is at least 1 msec.

75. A method according to any of claims 1-44, wherein the delay is at least 3 msec.

76. A method according to any of claims 1-44, wherein the delay is at least 7 msec.

77. A method according to any of claims 1-44, wherein the delay is at least 15 msec.

78. A method according to any of claims 1-44, wherein the delay is at least 30 msec.

79. A method according to any of claims 1-44, wherein the electric field has an exponential temporal envelope.

80. A method according to any of claims 1-44, wherein the electric field has a square temporal envelope.

81. A method according to any of claims 1-44, wherein the electric field has a triangular temporal envelope.

82. A method according to any of claims 1-44, wherein the electric field has a ramped temporal envelope.

83. A method according to any of claims 1-44, wherein the electric field has a biphasic temporal envelope.

84. A method according to any of claims 1-44, wherein the electric field comprises an AC electric field.

85. A method according to claim 84, wherein the electric field has a sinusoidal temporal envelope.

86. A method according to claim 84, wherein the electric field has a sawtooth temporal envelope.

87. A method according to claim 84, wherein the electric field has a square-wave temporal envelope.

88. A method according to any of claims 1-44, wherein the portion of the chamber has an inside surface and an outside surface, wherein the field is applied along the inner surface.

89. A method according to any of claims 1-44, wherein the portion of the chamber has a normal conduction direction, wherein the field is applied along the normal conduction direction.

90. A method according to any of claims 1-44, wherein the portion of the chamber has a normal conduction direction, wherein the field is applied perpendicular to the normal conduction direction.

91. A method according to any of claims 1-22 or 29-44, wherein the field is applied between at least two electrodes.

92. A method according to claim 91, wherein the electrodes are at least 2 cm apart.

93. A method according to claim 91, wherein the electrodes are at least 4 cm apart.

94. A method according to claim 91, wherein the electrodes are at least 9 cm apart.

95. A method according to any of claims 1-44, wherein the chamber is the left ventricle.

96. A method according to any of claims 1-44, wherein the chamber is the left atrium.

97. A method according to any of claims 1-44, wherein the chamber is the right ventricle.

98. A method according to any of claims 1-44, wherein the chamber is the right atrium.

99. A method according to any of claims 1-44 and comprising pacing the heart.

100. A method according to claim 99, wherein applying the electric field is synchronized with the pacing.

101. A method according to claim 99, comprising calculating the delay based on the pacing.

102. A method according to any of claims 1-29 or 36-44, comprising sensing a specific activation at a site.

103. A method of modifying the activation profile of at least a portion of a heart, comprising,
mapping the activation profile of the portion;
determining a desired change in the activation profile; and
blocking the activation of at least a segment of the portion, to achieve the desired change, wherein the segment is not part of a reentry circuit or an arrhythmia foci in the heart.

104. A method according to claim 103, wherein the blocked segment is an ischemic segment.

105. A method of modifying the activation profile of at least a portion of a heart, comprising,
mapping the activation profile of the portion;
determining a desired change in the activation profile; and
changing the refractory period of at least a segment of the portion, to achieve the

desired change, wherein the segment is not part of a reentry circuit or an arrhythmia foci in the heart.

106. A method of modifying the heart rate of a heart, comprising:

providing a subject having a heart with an active natural pacemaker region; and

applying a non-excitatory electric field to the region.

107. A method according to claim 106, wherein the electric field extends a duration of an action potential of the region.

108. A method according to claim 106, comprising, extending the refractory period of a significant portion of the right atrium.

109. A method of reducing an output of a chamber of a heart, comprising:

determining the earliest activation of at least a portion of the chamber, which portion is not part of an abnormal conduction pathway in the heart; and

applying a non-excitatory electric field to the portion.

110. A method according to claim 109, wherein the field is applied prior to activation of the portion.

111. A method according to claim 109, wherein the field reduces the reactivity of the portion to an activation signal.

112. A method according to claim 109, wherein the field reduces the sensitivity of the portion to an activation signal.

113. A method of reducing an output of a chamber of a heart, comprising:

determining an activation of and conduction pathways to at least a portion of the chamber; and

reversibly blocking the conduction pathways, using a locally applied non-excitatory electric field.

114. A method of reducing an output of a chamber of a heart, comprising:

determining an activation of and a conduction pathway to at least a portion of the chamber, which portion is not part of an abnormal conduction pathway in the heart; and

reversibly reducing the conduction velocity in the conduction pathway, using a locally applied electric field.

115. A method of performing cardiac surgery, comprising:

blocking the electrical activity to at least a portion of the heart using a non-excitatory electric field; and

performing a surgical procedure on the portion.

116. A method of performing cardiac surgery, comprising:

reducing the sensitivity to an activation signal of at least a portion of the heart using a non-excitatory electric field; and

performing a surgical procedure on the portion.

117. A method of controlling the heart, comprising,

providing a subject having a heart with a left ventricle and a right ventricle;

selectively reversibly increasing the contractility of one of the ventricles relative to the other ventricle.

118. A method according to claim 117, wherein selectively reversibly increasing comprises applying a non-excitatory electric field to at least a portion of the one ventricle.

119. A method of controlling the heart, comprising,

providing a subject having a heart with a left ventricle and a right ventricle;

selectively reversibly reducing the contractility of one of the ventricles, relative to the other ventricle.

120. A method according to claim 119, wherein selectively reversibly reducing comprises applying a non-excitatory electric field to at least a portion of the one ventricle.

121. A method of treating a segment of a heart which induces arrhythmias due to an abnormally low excitation threshold, comprising:

identifying the segment; and

applying a desensitizing electric field to the segment, such that the excitation threshold is increased to a normal range of values.

122. A method of modifying an activation profile of at least a portion of a heart, comprising:

determining a desired change in the activation profile; and

reversibly blocking the conduction of activation signals across a plurality of elongated fence portions of the heart to achieve the desired change.

123. A method according to claim 122, wherein blocking the conduction creates a plurality of segments, isolated from external activation, in the portion of the heart.

124. A method according to claim 123, wherein at least one of the isolated segments contains an arrhythmia foci.

125. A method according to claim 123, wherein at least one of the isolated segments does not contain an arrhythmia foci.

126. A method according to claim 122, comprising individually pacing each of at least two of the plurality of isolated segments.

127. A method according to claim 122, wherein blocking the conduction limits an activation front from traveling along abnormal pathways.

128. A method according to claim 122, wherein reversibly blocking comprises reversibly blocking conduction of activation signals, synchronized with a cardiac cycle, to block abnormal activation signals.

129. A method according to claim 122, wherein reversibly blocking comprises reversibly blocking conduction of activation signals, synchronized with a cardiac cycle, to pass normal activation signals.

130. A method of treating abnormal activation of the heart, comprising:

detecting an abnormal activation state; and

modifying the activation of the heart in accordance with any of claims 122-129 to stop the abnormal activation condition.

131. A method according to claim 130, wherein the abnormal condition is fibrillation.

132. A method of controlling the heart comprising:

determining a desired range of values for at least one parameter of cardiac activity; and

controlling at least a local force of contraction in the heart to maintain the parameter within the desired range.

133. A method according to claim 132, wherein controlling includes controlling the heart rate.

134. A method according to claim 132, wherein controlling includes controlling a local conduction velocity.

135. A method according to claim 132, wherein the parameter responds to the control with a

time constant of less than 10 minutes.

136. A method according to claim 132, wherein the parameter responds to the control with a time constant of over one day.

137. A method of controlling the heart, comprising:

determining a desired range of values for at least one parameter of cardiac activity;

controlling at least a portion of the heart using a non-excitatory electric field having at least one characteristic, to maintain the parameter within the desired range; and

changing the at least one characteristic in response to a reduction in a reaction of the heart to the electric field.

138. A method according to claim 137, wherein the characteristic comprises a strength of the electric field.

139. A method according to claim 137, wherein the characteristic comprises a duration of the electric field.

140. A method according to claim 137, wherein the characteristic comprises a frequency of the field.

141. A method according to claim 137, wherein the characteristic comprises a waveform of the field.

142. A method of treating a patient having a heart with an unhealed infarct, comprising, applying the method of any of claims 1-50, 103-129 or 132-141, until the infarct is healed.

143. A method of treating a patient having a heart, comprising,

providing a patient, having an unhealed infarct in the heart; and

applying the method of any of claims 1-50, 103-129 or 132-141, until the heart is stabilized.

144. A method according to any of claims 1-50, 103-129 or 132-141, wherein applying a non-excitatory field comprises applying a non-excitatory field for between 3 and 5000 heart beats.

145. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across at least a portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field, for

a given duration at least 100 times during a period of less than 50,000 cardiac cycles.

146. Apparatus according to claim 145, wherein the electrodes are electrified at least 1000 times during a period of less than 50,000 cardiac cycles.

147. Apparatus according to claim 145, wherein the electrodes are electrified at least 1000 times during a period of less than 20,000 cardiac cycles.

148. Apparatus according to claim 145, wherein the electrodes are electrified at least 1000 times during a period of less than 5,000 cardiac cycles.

149. Apparatus according to claim 145, wherein the field is applied less than 10 times in one second.

150. Apparatus according to claim 145, wherein the power supply electrifies the electrodes at least 2000 times over the period.

151. Apparatus according to claim 145, wherein the power supply electrifies the electrodes at least 4000 times over the period.

152. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across at least a portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field, for a given duration,

wherein at least one of the electrodes is adapted to cover an area of the heart larger than 2 cm^2.

153. Apparatus according to claim 152, wherein at least one of the electrodes is adapted to cover an area of the heart larger than 6 cm^2.

154. Apparatus according to claim 152, wherein at least one of the electrodes is adapted to cover an area of the heart larger than 9 cm^2.

155. Apparatus for controlling a heart comprising:

at least one unipolar electrode adapted to apply an electric field to at least a portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field.

156. Apparatus according to claim 155, comprising a housing, which is electrified as a second electrode.

157. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across at least a portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field, for a given duration,

wherein the distance between the electrodes is at least 2 cm.

158. Apparatus according to claim 157, wherein the distance is at least 4 cm.

159. Apparatus according to claim 157, wherein the distance is at least 9 cm.

160. Apparatus for controlling a heart comprising:

at least three electrodes adapted to apply an electric field across at least a portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field, for a given duration,

wherein the electrodes are selectively electrifiable in at least a first configuration where two electrodes are electrified and in a second configuration where two electrodes, not both identical with the first configuration electrodes, are electrified.

161. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across at least a portion of the heart;

a sensor which senses a local activation; and

a power supply which electrifies the electrodes with a non-excitatory electric field, for a given duration, responsive to the sensed local activation.

162. Apparatus according to claim 161, wherein the sensor senses a mechanical activity of the portion.

163. Apparatus according to claim 161, wherein the sensor is adapted to sense the activation at at least one of the electrodes.

164. Apparatus according to claim 161, wherein the sensor is adapted to sense the activation in the right atrium.

165. Apparatus according to claim 161, wherein the sensor is adapted to sense the activation between the electrodes.

166. Apparatus according to claim 161, wherein the sensor senses an earliest activation in a chamber of the heart including the portion and wherein the power supply times the electrification responsive to the earliest activation.

167. Apparatus for controlling a heart comprising:

electrodes adapted to apply an electric field across elongate segments of at least a portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field.

168. Apparatus according to claim 167, wherein the electrodes are elongate electrodes.

169. Apparatus according to claim 167, wherein the power supply electrifies the electrodes for a given duration of at least 20 msec, at least 1000 times over a period of less than 5000 cardiac cycles.

170. Apparatus according to claim 167, wherein the elongate segments are at least 1 cm long.

171. Apparatus according to claim 167, wherein the elongate segments are at least 2 cm long.

172. Apparatus according to claim 167, wherein the elongate segments are at least 4 cm long.

173. Apparatus according to claim 167, wherein the elongate segments are less than 2 cm wide.

174. Apparatus according to claim 167, wherein the elongate segments are less than 1 cm wide.

175. Apparatus according to claim 167, wherein the elongate segments are less than 0.5 cm wide.

176. Apparatus according to claim 167, wherein the elongate segments are less than 0.3 cm wide.

177. Apparatus according to claim 167, wherein the elongate segments divide the heart into at least two electrically isolated segments in the heart.

178. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across at least a portion of the heart;

a power supply which electrifies the electrodes with a non-excitatory electric field, for a given duration; and

a circuit for determining an activation at a site in the portion,

wherein the power supply electrifies the electrodes responsive to the determined activation.

179. Apparatus according to any of claims 161-166 or 178, wherein the electric field is applied at a given delay after an activation at one of the electrodes.

180. Apparatus according to claim 179, wherein the delay is less than 70 msec.

181. Apparatus according to any of claims 161-166 or 178, wherein the electric field is applied before an activation at one of the electrodes.

182. Apparatus according to claim 181, wherein the field is applied more than 30 msec before the activation.

183. Apparatus according to claim 181, wherein the field is applied more than 50 msec before the activation.

184. Apparatus according to claim 181, wherein the field is applied more than 80 msec before the activation.

185. Apparatus according to claim 178, wherein the circuit comprises an activation sensor which senses the activation.

186. Apparatus according to claim 178, wherein the activation is calculated.

187. Apparatus according to claim 186, wherein the activation is calculated based on an activation in a chamber of the heart different from a chamber including the portion.

188. Apparatus according to claim 178, comprising a memory which stores values used to calculate a delay time, associated with a value of at least a parameter of a sensed ECG.

189. Apparatus according to claim 188, wherein the parameter comprises a heart rate.

190. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across at least a portion of the heart;

a power supply which electrifies the electrodes with a non-excitatory electric field, for a given duration;

a sensor which measures a parameter of cardiac activity; and

a controller which controls the electrification of the electrodes to maintain the parameter within a range of values.

191. Apparatus according to claim 190, comprising a memory which stores a map of electrical activity in the heart, wherein the controller uses the map to determine a desired electrification.

192. Apparatus according to claim 190, comprising a memory which stores a model of electrical activity in the heart, wherein the controller uses the model to determine a desired electrification.

193. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across at least a portion of the heart;

a power supply which electrifies the electrodes with a non-excitatory electric field, for a given duration; and

a controller which measures a reaction of the heart to the electrification of the electrodes.

194. Apparatus according to claim 193, wherein the controller changes the electrification based on the measured reaction.

195. Apparatus according to claim 193, comprising a memory which stores the measured reaction.

196. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across at least a portion of the heart;

a power supply which electrifies the electrodes with a non-excitatory electric field, for a given duration; and

a pacemaker which paces the heart.

197. Apparatus according to claim 196, wherein the pacemaker and the remainder of the apparatus are contained in a common housing.

198. Apparatus according to claim 196, wherein the pacemaker and the remainder of the apparatus utilize common excitation electrodes.

199. Apparatus according to claim 196, wherein and the pacemaker and the remainder of the apparatus utilize a common power supply.

200. Apparatus according to claim 196, wherein the non-excitatory field is synchronized to the pacemaker.

201. Apparatus according to claim 198, wherein the electrodes are electrified using a single pulse which combines a pacing electric field and a non-excitatory electric field.

202. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across at least a portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field, for a given duration,

wherein at least one of the electrodes is mounted on a catheter.

203. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across at least a portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field, for a given duration,

wherein the electrodes are adapted to be applied externally to the body.

204. Apparatus according to claim 203, comprising an external pacemaker.

205. Apparatus according to claim 203, comprising an ECG sensor, to which electrification of the electrodes is synchronized.

206. Apparatus according to any of claims 145-178 or 185-205, wherein the duration is at least 20 msec.

207. Apparatus according to any of claims 145-178 or 185-205, wherein the duration is at least 40 msec.

208. Apparatus according to any of claims 145-178 or 185-205, wherein the duration is at least

80 msec.

209. Apparatus according to any of claims 145-178 or 185-205, wherein the duration is at least 120 msec.

210. Apparatus according to any of claims 145-178 or 185-205, wherein a current is forced through the portion, between the electrodes.

211. Apparatus according to any of claims 145-178 or 185-205, comprising at least another two electrodes, electrified by the power supply and adapted to apply a non-excitatory electric field across a second portion of the heart.

212. Apparatus according to claim 211, comprising a controller which coordinates the electrification of all the electrodes in the apparatus.

213. Apparatus according to any of claims 145-178 or 185-205, wherein a peak current through the electrodes is less than 20 mA.

214. Apparatus according to any of claims 145-178 or 185-205, wherein a peak current through the electrodes is less than 10 mA.

215. Apparatus according to any of claims 145-178 or 185-205, wherein a peak current through the electrodes is less than 5 mA.

216. Apparatus according to any of claims 145-178 or 185-205, wherein a peak current through the electrodes is less than 2 mA.

217. Apparatus according to any of claims 145-178 or 185-205, wherein the electrodes are substantially in contact with the heart.

218. Apparatus according to any of claims 145-178 or 185-205, wherein the electric field has an exponential envelope.

219. Apparatus according to any of claims 145-178 or 185-205, wherein the electric field has an triangular envelope.

220. Apparatus according to any of claims 145-178 or 185-205, wherein the electric field has an square wave envelope.

221. Apparatus according to any of claims 145-178 or 185-205, wherein the electric field is unipolar.

222. Apparatus according to any of claims 145-178 or 185-205, wherein the electric field is bipolar.

223. Apparatus according to any of claims 145-178 or 185-205, wherein the electric field has a constant strength.

224. Apparatus for optical control of a heart, comprising:

at least one implantable light source which generates pulses of light, for at least 1000 cardiac cycles, over a period of less than 5000 cycles; and

at least one wave guide for providing non-damaging intensities of light from the light source to at least one site on the heart.

225. Apparatus according to claim 224, wherein the at least one light source comprises a plurality of light sources, each attached to a different site on the heart.

226. Apparatus according to claim 224, wherein the wave guide is an optical fiber.

227. Apparatus according to any of claims 224-226, wherein the light source comprises a monochrome light source.

228. Apparatus according to any of claims 224-226, comprising a sensor, which measures an activation of at least portion of the heart, wherein the light source provides pulsed light in synchrony with the measured activation.

229. A method of programming a programmable controller for a subject having a heart, comprising:

determining pulse parameters suitable for controlling the heart using non-excitatory electric fields; and

programming the controller with the pulse parameters.

230. A method according to claim 229, wherein determining pulse parameters comprises determining a timing of the pulse relative to a cardiac activity.

231. A method according to claim 230, wherein the cardiac activity is a local activation.

232. A method according to claim 230, wherein determining a timing comprises determining

timing which does not induce fibrillation in the heart.

233. A method according to claim 230, wherein determining a timing comprises determining a timing which does not induce an arrhythmia in the heart.

234. A method according to any of claims 230-233, wherein determining a timing comprises determining the timing based on a map of an activation profile of the heart.

235. A method according to any of claims 230-233, wherein determining a timing comprises calculating a delay time relative to a sensed activation.

236. A method according to any of claims 229-233, wherein controlling the heart comprises modifying the contractility of the heart.

237. A method of determining an optimal placement of at least two individual electrodes for controlling a heart using non-excitatory electric fields, comprising:

determining an activation profile of at least a portion of the heart; and

determining an optimal placement of the electrodes in the portion based on the activation profile.

238. A method according to claim 237, comprising determining an optimal location for an activation sensor, relative to the placement of the electrodes.

239. A method according to any of claims 237-238, wherein controlling comprises modifying the contractility.

240. A method according to any of claims 237-238, wherein controlling comprises creating elongate non-conducting segments in the heart.

241. A method of determining a timing parameter for a non-excitatory, repeatably applied pulse for a heart, comprising:

applying a non-excitatory pulse using a first delay;

determining if the pulse induces an abnormal activation profile in the heart; and

repeating applying a non-excitatory pulse using a second delay, shorter than the first, if the pulse did not induce abnormal activation in the heart.

242. A method of determining a timing parameter for a non-excitatory, repeatably applied pulse for a heart, comprising:

applying a non-excitatory pulse using a first delay;

determining if the pulse induces an abnormal activation profile in the heart; and

repeating applying a non-excitatory pulse using a second delay, longer than the first, if the pulse did not induce abnormal activation in the heart.

243. A method of programming a programmable controller for a heart, comprising:

controlling the heart using plurality of non-excitatory electric field sequences;

determining a response of the heart to each of the sequences; and

programming the controller responsive to the response of the heart to the non-excitatory sequences.

244. A method of controlling an epileptic seizure, comprising:

detecting an epileptic seizure in brain tissue; and

applying a non-excitatory electric field to the brain tissue to attenuate conduction of a signal in the tissue.

245. A method of controlling nervous signals in periphery nerves, comprising,

selecting a nerve; and

applying a non-excitatory electric field to the nerve to attenuate conduction of nervous signals in the nerve.

246. A method of controlling a heart having a chamber comprising:

applying a non-excitatory electric field to a first portion of a chamber, such that a force of contraction of the first portion is lessened; and

applying a non-excitatory electric field to a second portion of a chamber, such that a force of contraction of the second portion is increased.